Fermilab

CAMAC POWER SUPPLY MONITOR MODULE

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December 1976

PURPOSE

Most of the CAMAC power supplies at Fermilab do not provide adequate monitoring of the output voltages. To correct this situation, a CAMAC module has been designed which accurately monitors the +6 and +24 power supply voltages in the CAMAC crate. The module provides a daisy chain alarm signal and status lights which indicate when any of the power supply voltages are outside a pre-established voltage range, normally +1%. Hence, insipient CAMAC power supply failure or overloading can be discovered and corrected before a significant amount of data is affected. The module also provides convenient front panel test points to directly monitor the CAMAC dataway D.C. power buses with a digital voltmeter. The CAMAC power supply monitor module is currently available from PREP.

GENERAL OPERATION

The single-width CAMAC monitor module obtains its power from the crate which it is monitoring. A general understanding of how the monitor module operates can be obtained from Figure 1. The input +24 and +6 voltage sources are used to generate a +5V nominal power source and a +2.5V nominal reference for use in

the module's monitor and internal test circuits. Similarly, the input -24 and -6 volt sources are used to develop a -5V power source and a -2.5 volt reference. The voltage conditioner circuits shown in Figure 1 operate in such a manner that the ±5 and ±2.5 voltages are available even if one of the positive input sources and one of the negative input sources fail completely. One monitor circuit is used to watch each of the four input source voltages. Each of the monitor circuits is essential identical. A typical monitor circuit has an input divider-circui which has a 0.000V output when the source voltage is exactly equal to its nominal value. If the source voltage changes by ±1%, the divider output changes by +17.6mV correspondingly. A non-inverting amplifier, with a gain of 140 increases the divider output swing to ±2.5V for a source change of ±1%. A window comparator, with a threshold of ±2.5V produces a T^2L compatible low output signal whenever the source voltage exceeds ±1% of its nominal value. A low comparator output drives a one-second re-triggerable one-shot which causes a status LED to light, indicating that the corresponding source voltage is "out-of-tolerance". The one-shot circuit is connected in such a way that the LED remains on one second longer than the source voltage is out-of-tolerance. The output of the comparator is ANDed with the other three monitor circuit outputs to produce an open-collector output signal that indicates one of the crate voltages is "out-of-tolerance". The open collector output is for use as part of a daisy-chain alarm system. In addition to the four source monitors, there is a "power-off monitor", which insures that the open collector alarm signal is always correct, even

when the CAMAC crate is off. Typical operating ranges for the monitor circuits are given in the next section.

The CAMAC monitor module has an internal test circuit which allows all of the monitor circuits to be checked simultaneously. By means of a front panel switch, a plus and minus 1.2% error signal can be applied to all of the monitor circuits. Under these conditions, all of the status LED's should be "ON" indicating that a similar change in the source voltages would cause the monitor module to indicate an "out-of-tolerance" CAMAC power supply. (A 1.2% test signal is used to insure that the test circuit is useful over a wide range of operating conditions). As an additional diagnostic aid, the ±24 and ±6 volt source voltages are brought to monitor points on the front panel through 1KΩ isolating resistors.

CIRCUIT PERFORMANCE AND FEATURES

In order for the monitor modules to operate without frequent adjustments, the reference voltages, monitor divider ratios and amplifiers, shown in Figure 2, must have adequate long term stability and low temperature coefficients. When all the critical components are considered, the worst condition change or error in the divider output signal for a 10^{0}C change in temperature is 4.13%. Under these conditions, the monitor module would indicate a fault if a power supply output was at 1.00±.04% of its normal value.

Another factor to consider in the performance of the module is the power supply voltage ranges over which the LED and alarm output status are valid. Table I lists these ranges.

CONDITION	POWER SUPPLIES	RANGE	LED STATUS	ALARM STATUS
I	Any or all +24, +6, -6, -24	±20% of nominal	Correct	Correct
II	Both -24 and -6 or both +24 and +6	Greater than ±20% of nominal	Unreliable	Correct
III	All	OV	Incorrect	Correct

Table I - Alarm and Status Conditions

To summarize the CAMAC monitor module, some important features and characteristics of the module are given below:

FEATURES*

1. Single-width CAMAC module construction.
2. Front panel power supply test points.
3. Front panel LED status lights to indicate which power supplies are out-of-tolerance.
4. Front panel test switch to check performance of module.
5. Front panel LEMO connector with open collector alarm signal suitable for daisy chain operation.

CHARACTERISTICS

1.	Power supply alarm trip settings	±1.0%V nom
2.	Power supply alarm trip setting tempco	4130 ppm/°C max
3.	Test circuit setting	±1.2%V nom typ.
4.	Power supply requirements +24, +6	160ma max
	-24, -6	63ma max
5.	Open collector alarm output voltage	30V max
	current	150ma max
6.	Frequency response (Linear portion of circuit)	-3DB at 6KC

*See Figure 3

7.	Open collector alarm output response to ±2%V nom change about V nom	25µsec typ.
8.	Operating ambient temperature range	0 - 55°C

REFERENCES

1. Memo to Q. Kerns from R. Shafer; Subject: "Project Request - CAMAC Power Monitor Module", December 23, 1975.

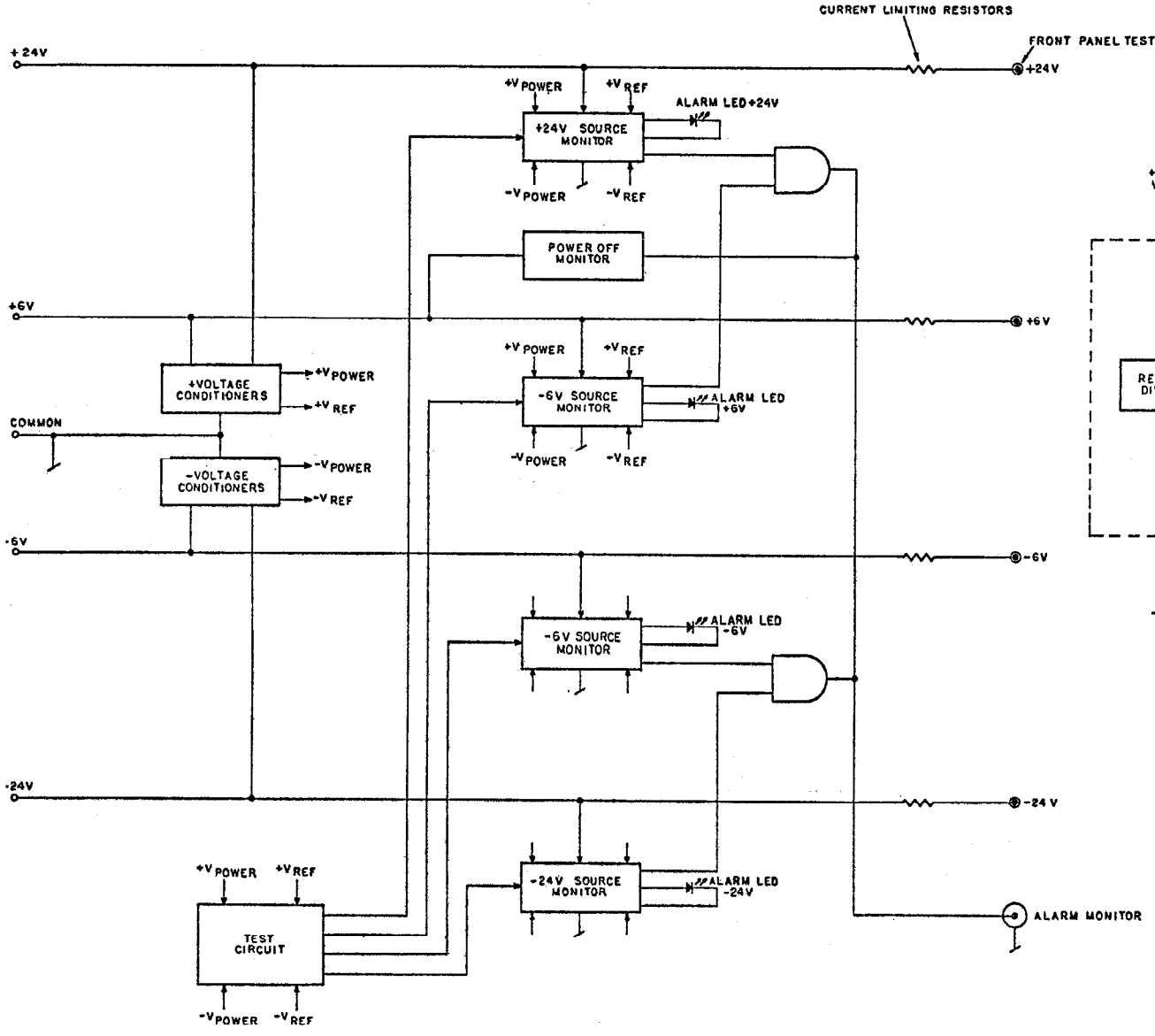
2. "CAMAC Power Supply Monitor Module" - Research Services Internal Report, R. Yarema, May 1976.

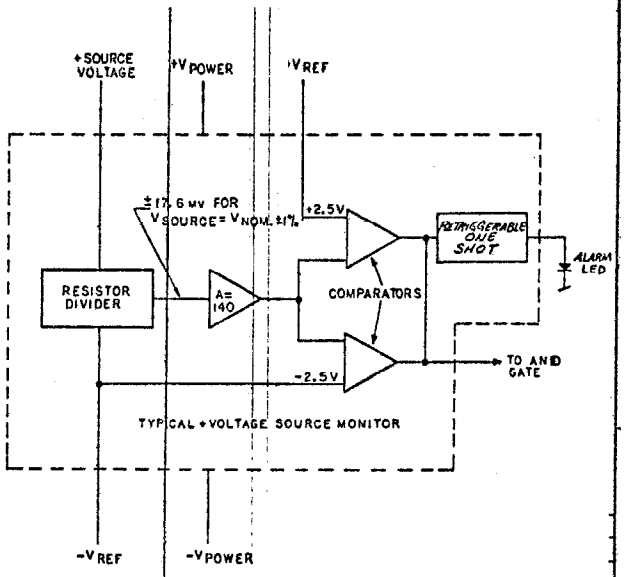
FIGURES

1. Research Services CAMAC Power Supply Alarm Module. Block Diagram Drawing Number 0810.700-ED-46398, Rev. A.

2. R.S.C.P.S.A.M. Schematic Drawing Number 0810.30-ED-46369, Rev. A.

3. R.S.C.P.S.A.M. Assembly Drawing Number 0810.700-MD-46394.





REVISIONS			
SYM	DESCRIPTION	DRAWN / APPD.	DATE
A	ADDED RETRIGGERABLE ONE SHOT	[illegible]	5-76

ITEM NO.	PART NO.	DESCRIPTION	QTY. REQ.

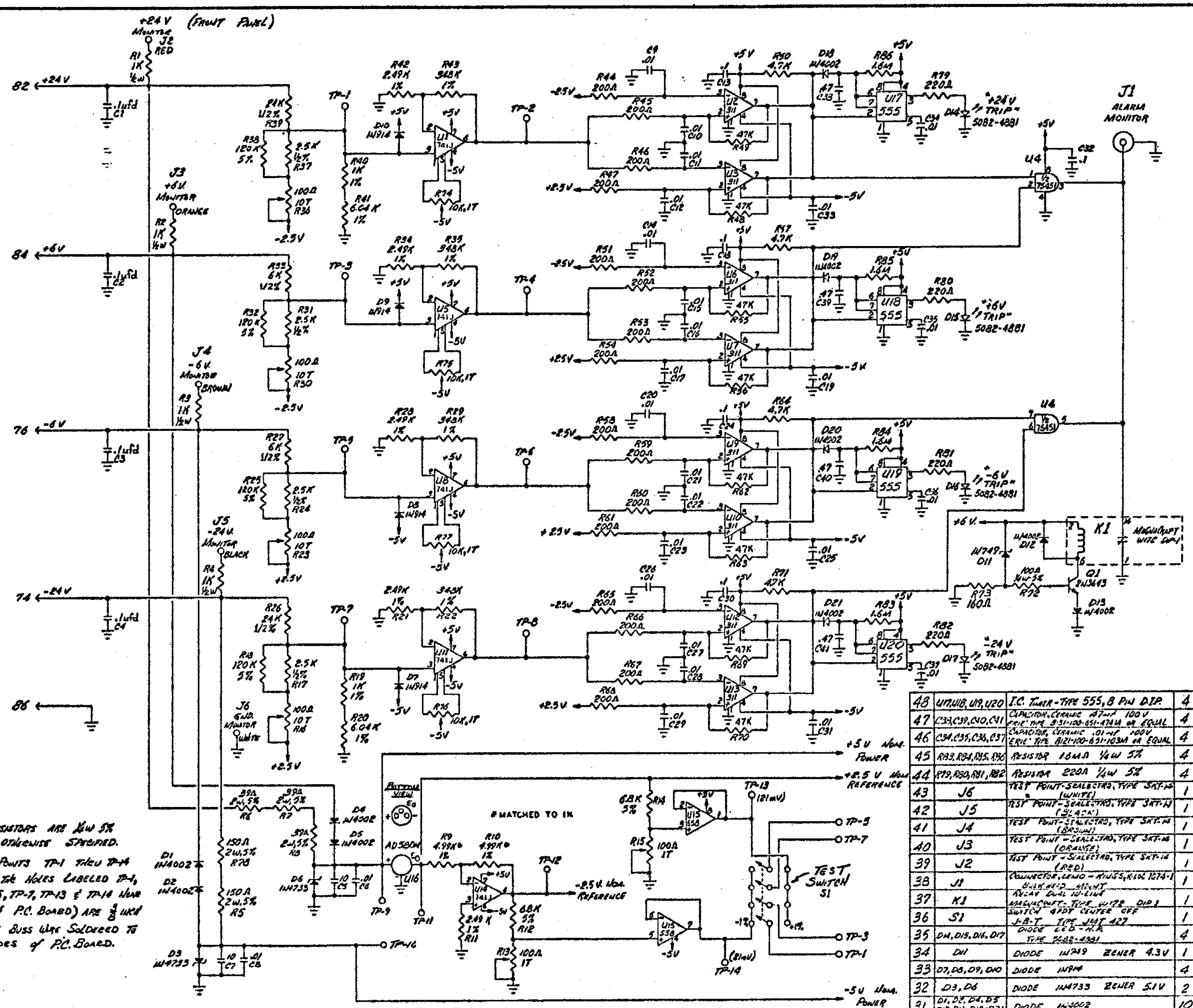
PARTS LIST

UNLESS OTHERWISE SPECIFIED	ORIGINATOR	YAREMA	
FRACTIONS / DECIMALS / ANGLES	DRAWN	GROZIS	4-28-76
	CHECKED	[illegible]	5-4-76
1. BREAK ALL SHARP EDGES 1/64 MAX.	APPROVED		
2. DO NOT SCALE DWG.	APPROVED		
3. DIMENSIONING IN ACCORD WITH USAS Y14.5 STD'S	USED ON		
MAX. ALL MACHINED SURFACES	MATERIAL -		

NATIONAL ACCELERATOR LABORATORY
U.S. ATOMIC ENERGY COMMISSION

RESEARCH SERVICES
CAMAC POWER SUPPLY ALARM MODULE
BLOCK DIAGRAM

SCALE	FILM ID	DRAWING NUMBER	REV.
~		0810.700-ED-46398	A



Notes:

1. All resistors are ¼w 5% unless otherwise specified.
2. Test points TP-1 thru TP-14 (except the holes labeled TP-1, TP-3, TP-5, TP-7, TP-13 & TP-14 near edge of P.C. Board) are ⅜ inch 22 gauge buss wire soldered to both sides of P.C. Board.

REVISIONS

SYM	DESCRIPTION	DRAWN / APPD.	DATE
A	Added type 555 timers & associated components.	W. Cerza / R. Ar...	2-76 / 6-76
B	Note #2 was added	Cadena	7-2-76

Continued next column

PARTS LIST

ITEM NO.	PART NO.	DESCRIPTION	QTY. REQ.
48	U17, U18, U19, U20	I.C. Timer - Type 555, 8 Pin DIP	4
47	C33, C39, C40, C41	Capacitor, Ceramic .47 μf 100V 'Erie' type 8131-100-651-474M or equal	4
46	C34, C35, C36, C37	Capacitor, Ceramic .01 μf 100V 'Erie' type 8121-100-651-103M or equal	4
45	R83, R84, R85, R86	Resistor 1.6 MΩ ¼w 5%	4
44	R79, R80, R81, R82	Resistor 220Ω ¼w 5%	4
43	J6	Test Point - Sealectro, Type SKT-14 (White)	1
42	J5	Test Point - Sealectro, Type SKT-14 (Black)	1
41	J4	Test Point - Sealectro, Type SKT-14 (Brown)	1
40	J3	Test Point - Sealectro, Type SKT-14 (Orange)	1
39	J2	Test Point - Sealectro, Type SKT-14 (Red)	1
38	J1	Connector, Lemo - Kings, K-10C 1074-1 Bulkhead Mount	1
37	K1	Relay Dual In-Line Magnecraft - Type W172 DIP 1	1
36	S1	Switch 4PDT Center Off J-B-T Type JMT 427	1
35	D14, D15, D16, D17	Diode LED - H.P. Type 5082-4881	4
34	D11	Diode 1N749 Zener 4.3V	1
33	D7, D8, D9, D10	Diode 1N914	4
32	D3, D6	Diode 1N4733 Zener 5.1V	2
31	D1, D2, D4, D5, D3, D13, D18-D21	Diode 1N4002	10
30	Q1	Transistor 2N3643	1
29	U16	I.C. Regulator Analog Devices AD580M	1
28	U4	I.C. Driver 75451	1
27	U15	I.C. Op Amp 72558	1
26	U2, U3, U6, U7, U9, U10, U12, U13	I.C. Comparator, Fairchild μA311HC	8
25	U1, U5, U8, U11, U14	I.C. Op Amp Analog Devices AD741J	5
24	C5, C7	Capacitor, Tantalum 10 μf 50V	2
23	C6, C8-C12, C14-C21, C23-C29, C31-C33	Capacitor, Ceramic .01 μfd 100V 'Erie' type 8121-100-651-103M or equal	22
22	C1, C2, C3, C4, C13, C14, C24, C30, C32	Capacitor, Ceramic .1 μfd 100V 'Erie' type 8131-100-651-104M or equal	9
21	R74, R75, R76, R77	Resistor, Pot, 1 Turn 10K Bourns Type 3329P	4
20	R73	Resistor, 160Ω ¼w 5%	1
19	R72	Resistor, 100Ω ¼w 5%	1
18	R50, R57, R64, R71	Resistor, 4.7K ¼w 5%	4
17	R49, R48, R55, R56, R62, R63, R69, R70	Resistor, 47K ¼w 5%	8
16	R58-R61, R65-R68, R44-R47, R51-R54	Resistor, 200Ω ¼ 5%	16
15	R27, R33	Resistor, 6K 1/2% M.F. 10 ppm/°C Vishay Type 102 CR Caddock Type TK	2
14	R26, R39	Resistor, 24K 1/2% M.F. 10 ppm/°C Vishay Type 102 or Caddock Type TK	2
13	R22, R29, R35, R43	Resistor, 348K 1% M.F. RN65C	4
12	R20, R41	Resistor, 6.04K 1% M.F. RN65C	2
11	R19, R40	Resistor, 1K 1% M.F. RN65C	2
10	R18, R25, R32, R38	Resistor, 120K ¼w 5%	4
9	R17, R24, R31, R37	Resistor, 2.5K ½% M.F. 10 ppm/°C Vishay Type S102/, Caddock Type TK	4
8	R16, R23, R30, R36	Resistor, Pot, 10 Turn 100Ω Beckman Helipot Type 66WR100	4
7	R13, R15	Resistor, Pot, 1 Turn 100Ω Bourns Type 3329P	2
6	R12, R14	Resistor, 6.8K ¼w 5%	2
5	R11, R21, R28, R34, R42	Resistor, 2.49K 1% M.F. RN65C	5
4	R9, R10	Resistor 4.99K 1% M.F. RN65C matched to 1%	2
3	R6, R7, R8	Resistor 39Ω 2w 5%	3
2	R5, R78	Resistor 150Ω 2w 5%	2
1	R1, R2, R3, R4	Resistor 1K ½w 5%	4

Unless otherwise specified		
Originator	R. Varela	
Drawn	[illegible]	
Checked	[illegible]	[illegible]
Approved	[illegible]	4-25-76
Approved		

Fractions ± · Decimals ± · Angles ±

1. Break all sharp edges 1/64 max.
2. Do not scale dwg.
3. Dimensioning in accord with USASI Y14.5 STD's.

√ max. all machined surfaces

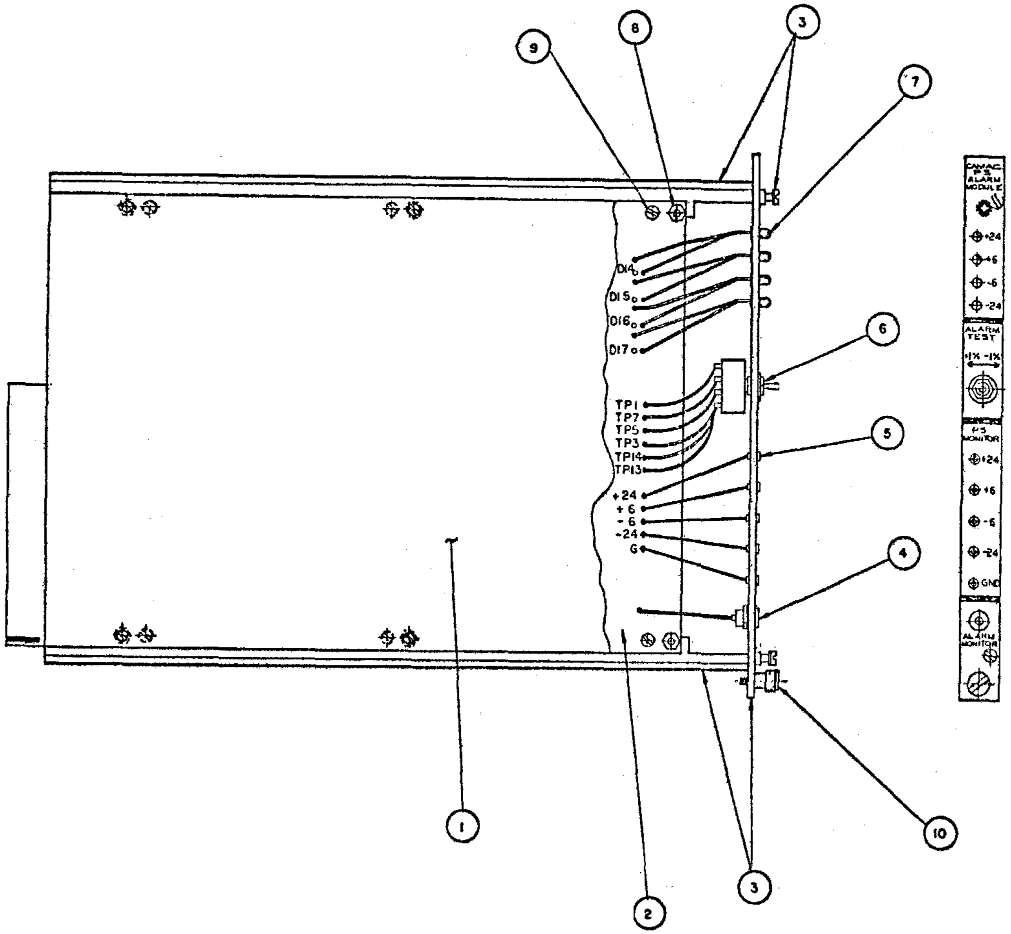
Used on

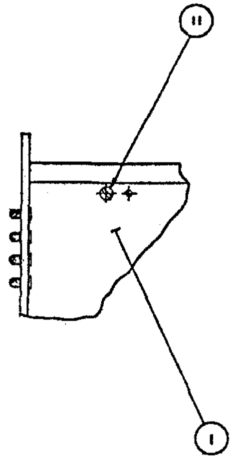
Material -

NATIONAL ACCELERATOR LABORATORY
U.S. ATOMIC ENERGY COMMISSION

Research Services
Camac Power Supply Alarm Module
Schematic

Scale: — · Drawing Number: 0310.30-ED-46369 · Rev. B





NOTE

1. ITEM 1 AND 6 PCS. OF ITEM 11 ARE FURNISHED WITH ITEM 3 HOWEVER AN EXTRA ITEM 1 AND 6 PCS OF ITEM 11 MUST BE ORDERED PER ASSEM.

REVISIONS

SYM	DESCRIPTION	DRAWN / APPD.	DATE / DATE

PARTS LIST

ITEM NO.	PART NO.	DESCRIPTION	QTY. REQ.
13			
12			
11		#4-40 FLT. HD. SCREW 5/32 LG.	12
10		NUCLEAR SPEC CAMAC JACKING SCREW	1
9		#4-40 BINDER HD SCREW 5/32 Lg.	6
8		HEX SPACER THD. #4-40 X 3/8	6
7		DIODE LED HP TYPE 5082-4881	4
6		SWITCH DPDT CENTER OFF J-B-T TYPE JMT427	1
5		SEALECTRO TYPE SKT-E4	5
4		Connector, Lemo-Fault Mount Bulkhead Kings #1074-1 (Fam #1835-4350)	1
3		NUCLEAR SPEC. 1 WIDE CAMAC MOD. 875DMSPH-1	1
2	MD-46390	P.C. BOARD	1
1		COVER (NSI CAMAC MODULE)	2

UNLESS OTHERWISE SPECIFIED: FRACTIONS ± DECIMALS ± ANGLES ±

1. BREAK ALL SHARP EDGES 1/64 MAX.
2. DO NOT SCALE DWG.
3. DIMENSIONING IN ACCORD WITH USASI Y14.5 STD'S.

MAX. ALL MACHINED SURFACES

ORIGINATOR	YAREMA	
DRAWN	C. GROZIS	4-26-76
CHECKED		4-27-76
APPROVED		4-27-76
APPROVED		
USED ON		
MATERIAL-		

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RESEARCH SERVICES
CAMAC POWER SUPPLY ALARM MODULE ASSEMBLY

SCALE 1:1 | FILMED | DRAWING NUMBER 0910.700-MD-1639-4 | REV.